Lowered Nighttime Velocities on Fishway Entrance Success by Pacific Lamprey at Bonneville Dam, 2007

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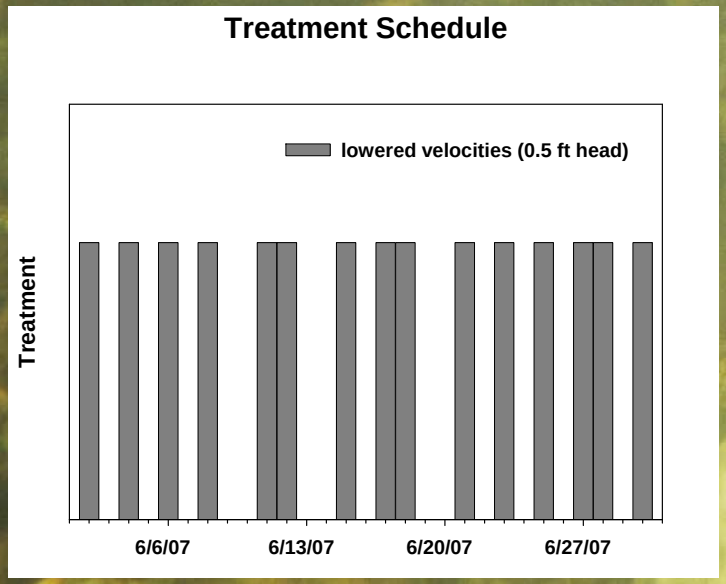
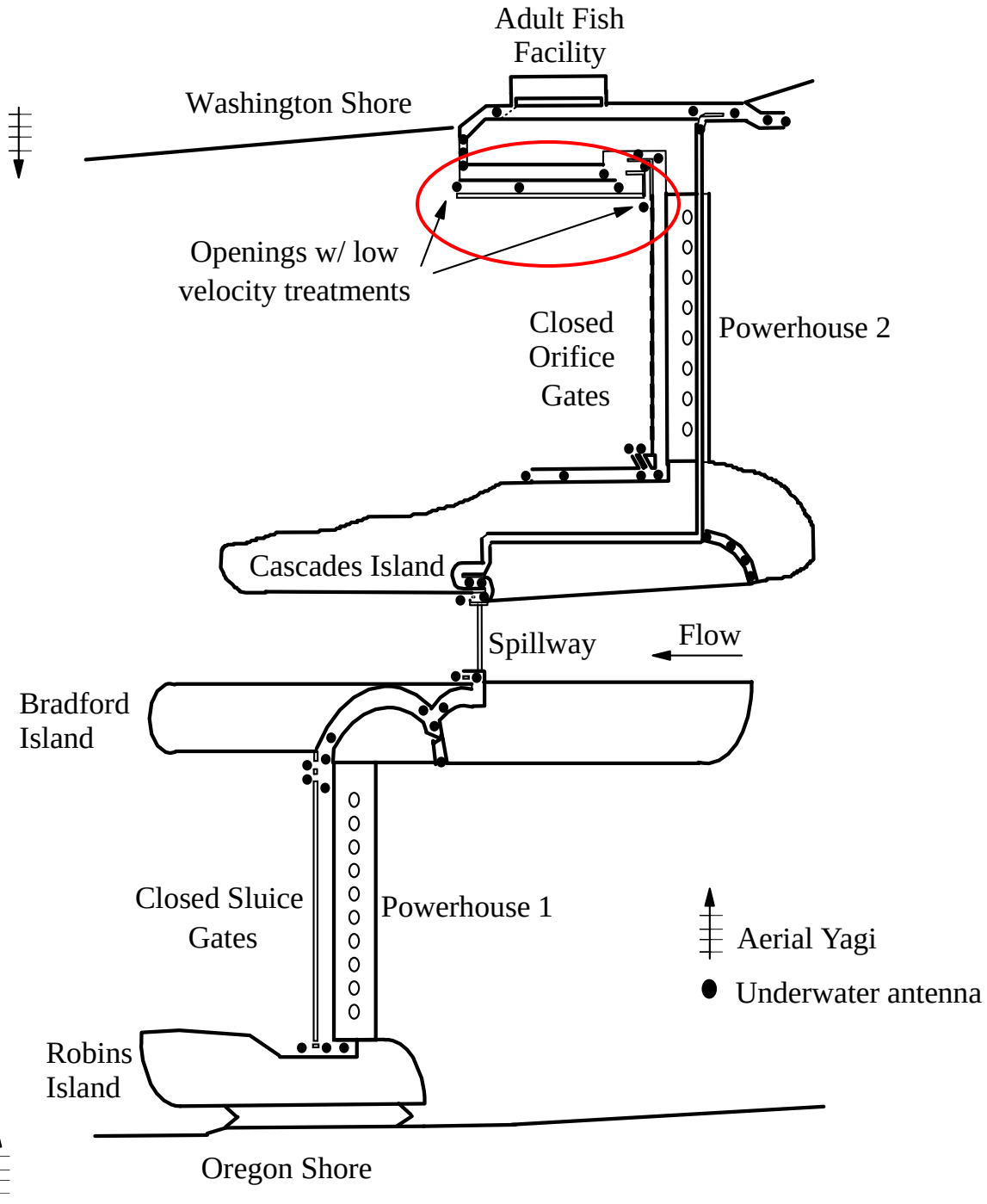
Background

- Lamprey numbers have decreased over past 50 years
  (4-10 fold decrease in annual counts; Close 2001)
- Bonneville Dam passage efficiencies are low (38-47%)
- Radio telemetry studies indicate difficulty negotiating entrances
- High water velocity at entrances?

Test

- Lower velocities at entrances at night 22:00 - 04:00 (target 4 ft · sec^{-1}; 0.5 ft head)
- Schedule one day each with or without treatment (randomized)
- Monitor passage with radiotelemetry



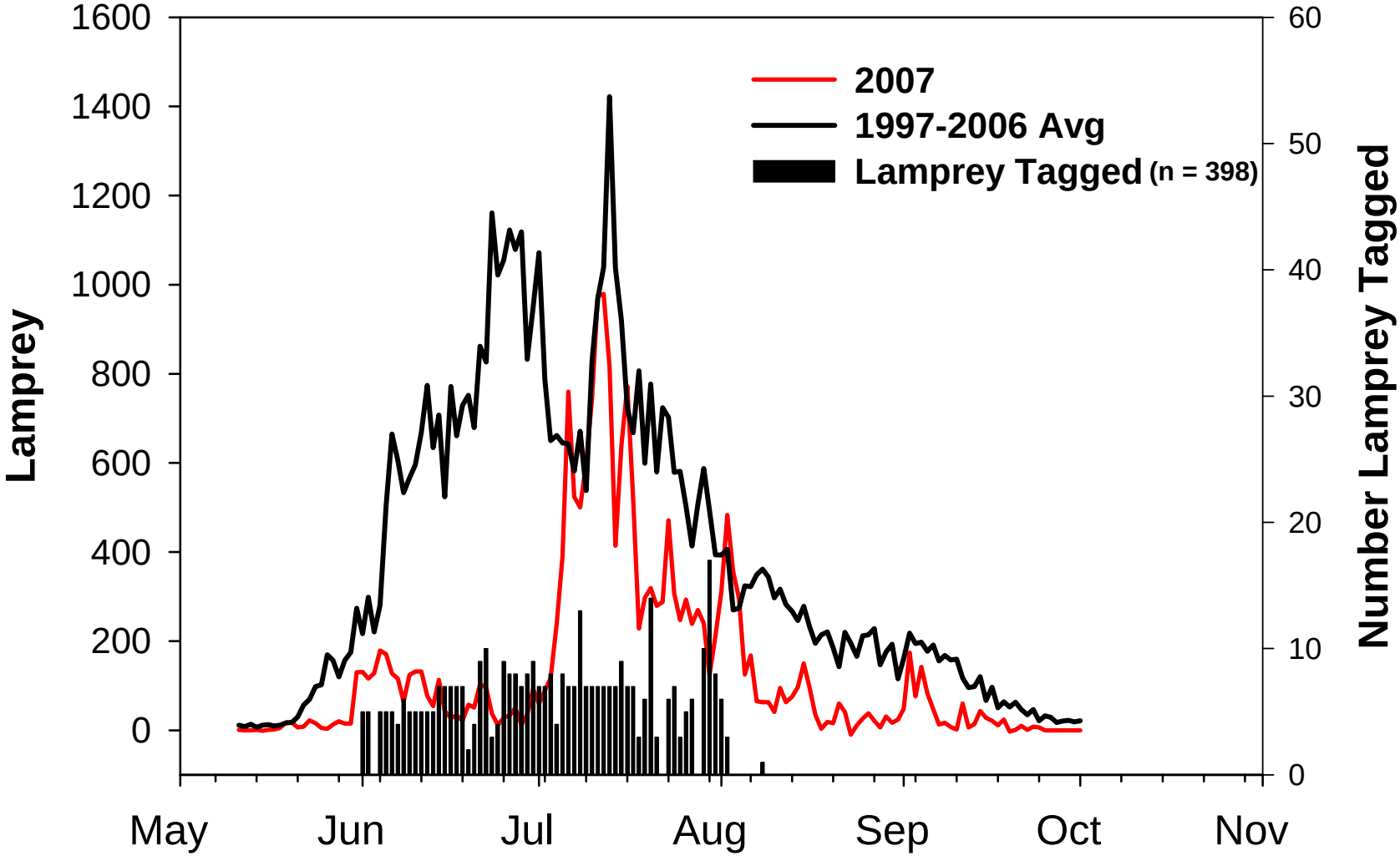

Adult Fish
Facility
Washington Shore
Openings w/ low
velocity treatments
Closed
Orifice
Gates
Powerhouse 2
Cascades Island
Spillway
Flow
Bradford
Island
Closed Sluice
Gates
Powerhouse 1
Aerial Yagi
Underwater antenna
Robins
Island
Oregon Shore

Methods

- Trapping at night when lamprey most active
- Anaesthetized in Eugenol (5 mg · L^{-1})
- Weighed and measured (length, girth, lipid content)
- Radio transmitter surgically implanted into body cavity
- Released into Bonneville tailrace
  (near Tanner Creek and Hamilton Is Boat Ramp)

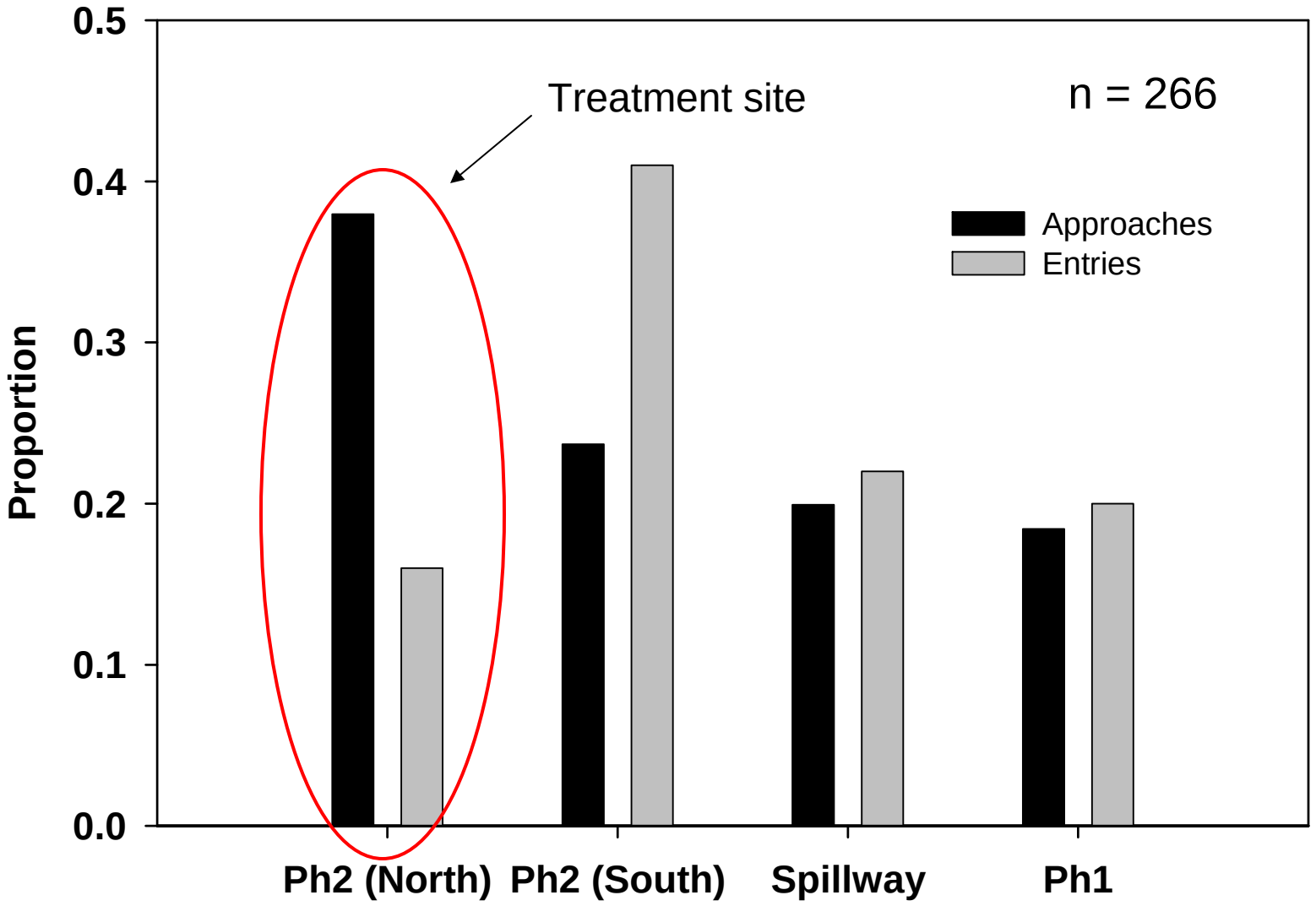

NRC-6-2
30 X 9 mm
235 d tag life

Bonneville Lamprey Counts



	1997	1998	1999	2000	2001	2002	2007
# Released	147	205	199	299	298	201	398
Length (cm)	70	70	71	70	77	72	66
Weight (g)	-	545	571	570	588	612	466
Detected @ BO	88%	89%	92%	87%	93%	96%	67%
Passage Efficiency	-	-	-	47%	46%	48%	21%
Fallback	-	-	-	-	-	1%	28%
Pass Dam (median)	-	-	-	-	-	9.0 d	2.7 d

Distribution of First Fishway Approach and Entry Sites



First Approaches and Entries

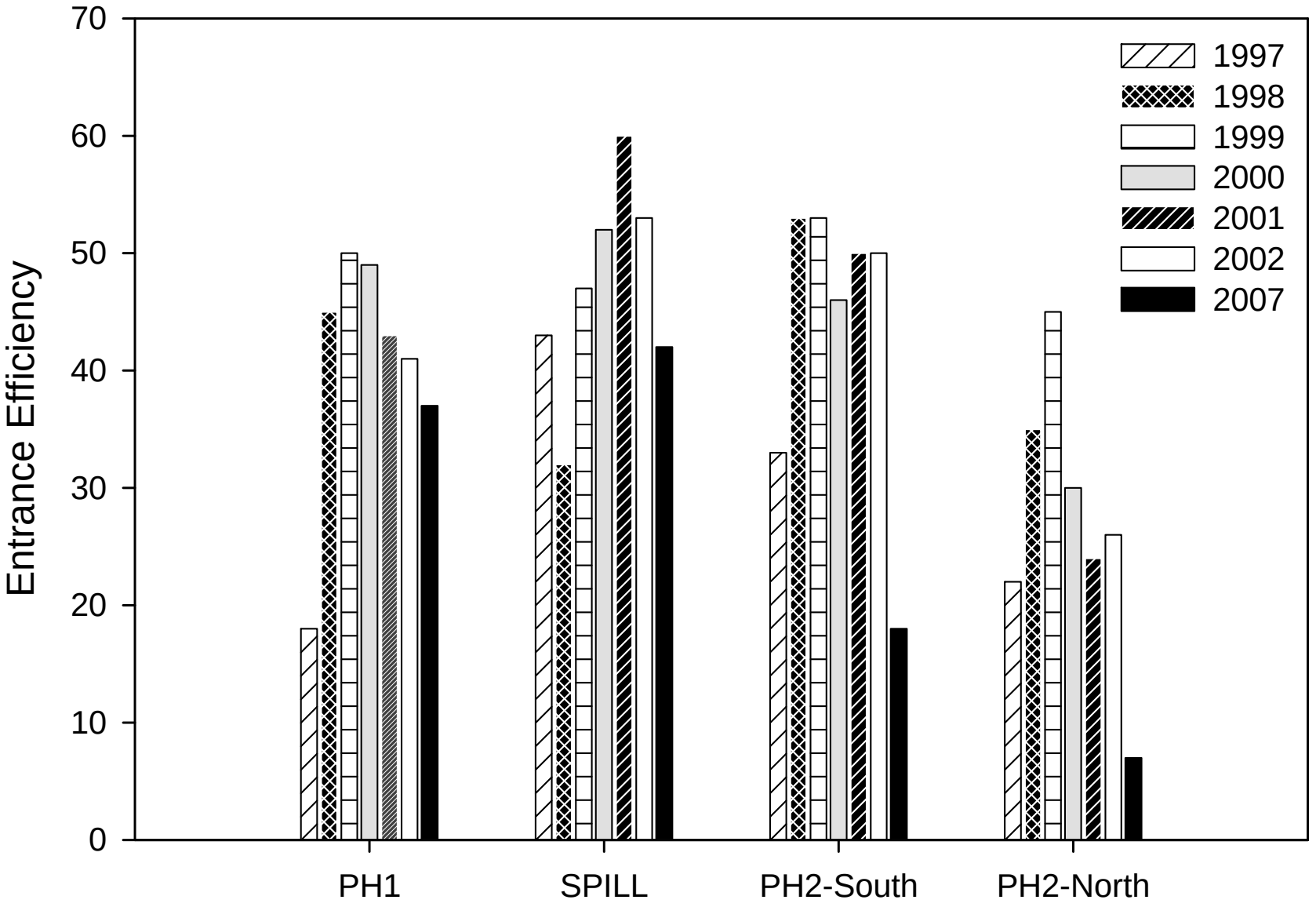
	Total	*PH1*	*Spill*	*PH2 S*	*PH2 N*
Approaches	266	18%	20%	24%	38%
Entries	193	20%	22%	41%	16%
Efficiency	73%	80%	81%	127%	31%

***Efficiency = total # entries / total # approaches**

First Approaches and Entries PH2 North

	PH2 N	*Normal*	*Low*
Approaches	38% (n=101)	68% (n=69)	32% (n=32)
Entries	16% (n=31)	23% (n=7)	77% (n=24)
Efficiency	31%	10%	75%

***Efficiency = total # entries / total # approaches**


Entrance Efficiency
70
60
50
40
30
20
10
0
1997
1998
1999
2000
2001
2002
2007
PH1
SPILL
PH2-South
PH2-North

All Approaches, Entries, and Exits

	PH2 N	*Normal*	*Low*
Approaches	859	78% (n=670)	22% (n=189)
Entries	64	22% (n=14)	78% (n=50)
Efficiency	7%	**2%**	**26%**
Exits	49	18	31
Net	15	-4	19

Median Passage Times

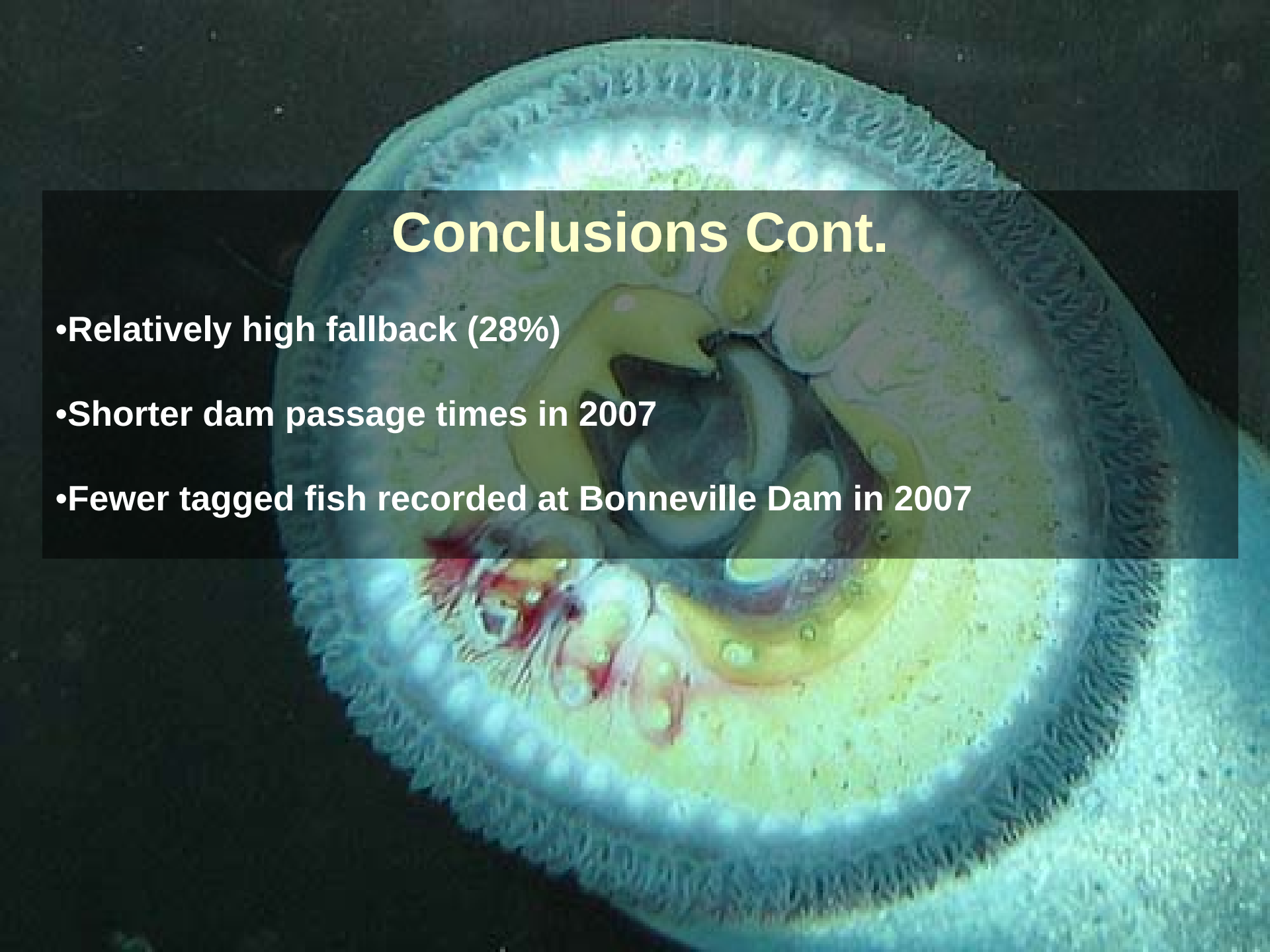
	Total	PH1	Spill	PH2 S	PH2 N	Normal	Low
(Approach to Entry)							
A1-E1	**0.9 h**	**0.5 h**	**1.0 h**	**1.0 h**	**2.8 h**	**5.9 h***	**1.5 h***
	(6 s - 60 d)					***(n=7)***	***(n=24)***

	Total	Bradford	Brad. AWS	Cascade Is.	Normal	Low
(Time to Pass Dam)						
A1-LT	**2.7 d**	**2.0 d**	**3.1 d**	**14.0 d**	**6.4 d***	**2.4 d***
	(4.2 h – 33 d)			***(n=1)***	***(n=28)***	***(n=8)***

***Mann-Whitney Rank Sum Test indicate no significant difference in median values between groups ($p > 0.05$)**

Conclusions

- Entrance efficiencies are higher during lower velocity treatments
- Benefits are less clear at non-north PH2 openings
- Lamprey still exit during lower velocity treatments



Conclusions Cont.

- Relatively high fallback (28%)
- Shorter dam passage times in 2007
- Fewer tagged fish recorded at Bonneville Dam in 2007

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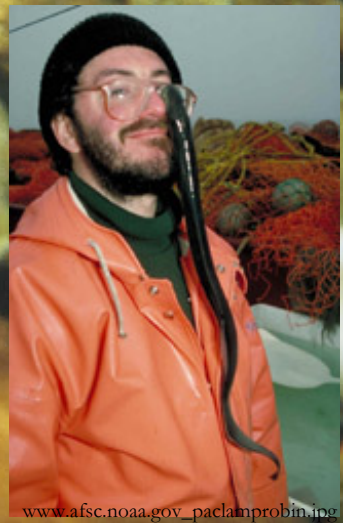

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